

Group roosting in the Grey-and-buff Woodpecker *Hemicircus concretus* involving large numbers of shallow cavities

MARTJAN LAMMERTINK

The Grey-and-buff Woodpecker *Hemicircus concretus* is a small, short-tailed picid endemic to the Sundaic region, and one of two species in the genus *Hemicircus* which is sister to all other genera in the true woodpeckers (Picinae). I report the unusual roosting behaviour of Grey-and-buff Woodpeckers observed at two roost sites in Kalimantan, Indonesian Borneo. Stable groups of three and four woodpeckers roosted individually in nearby cavities, with respectively 34 and 17 cavities per group, the adult males frequently working on excavation of additional cavities. The cavities were stacked above one another in series of up to 18 in one branch, and were clustered in adjacent dead branches or dead trees. Individual woodpeckers typically switched cavities within a cluster every night. The cavities were only about 2.5 cm deep below the entrance, and the woodpeckers roosted on the floors of these shallow cavities. In contrast, other woodpecker species typically sleep vertically against the wall of a deep cavity that is often an old nest cavity, rarely roost socially, have only a small number of roost cavities, and use the same cavity during prolonged series of nights. I speculate that Grey-and-buff Woodpeckers (1) roost on cavity floors because they are unable to prop themselves with their short tails against vertical cavity walls, (2) mitigate elevated predation risk in shallow cavities by roosting in groups, and (3) make shallow cavities to discourage cavity usurpers. Large numbers of cavities combined with frequent cavity switching, may allow evasion of predators and of feather and skin parasites.

INTRODUCTION

All woodpeckers, piculets and wrynecks roost overnight in holes during most if not all nights of their lives (Winkler & Christie 2002). Roost cavities offer protection against inclement weather and predators. Typically, roost cavities of woodpeckers are old nest holes, but occasionally woodpeckers excavate roost holes that are much like nest holes in shape and depth. Natural decay cavities in trees and nest boxes are sometimes used as roosts as well. Most woodpeckers roost in the vertical position while perched against the interior wall of the roost cavity, propped by their specialised climbing tail, the head and bill tucked into the feathers of the upper body (Blume 1968, Villard 1999, pers. obs.). The majority of woodpecker species roost solitarily, but some group-living species roost with several individuals in a shared cavity, or individually in a cluster of cavities in the same tree or nearby trees. Most woodpecker individuals use the same roost cavity for prolonged series of nights (Short 1982, Winkler *et al.* 1995, Winkler & Christie 2002).

The Grey-and-buff Woodpecker *Hemicircus concretus* is a small woodpecker of c.30 g and c.14 cm length, endemic to the Sundaic region from southern Myanmar to Borneo and Java. It has a very short tail that does not offer much support in vertical perching. Instead this woodpecker often perches sideways on trunks and branches, or on the undersides of branches, like a nuthatch *Sitta* sp. It is an active forager, moving rapidly between substrates, and it hammers frequently and powerfully. It can be found foraging solitarily, in small groups, and in mixed-species flocks. Almost nothing has been documented about its nesting and roosting habits (Winkler *et al.* 1995, Wells 1999).

In West Kalimantan, Indonesian Borneo, in 2000 I observed a group of Grey-and-buff Woodpeckers with roosting behaviour that was rather exceptional in many respects, including their excavating of a large number of cavities, the construction of these cavities specifically for use as roosts, the specialised shape of the cavities, the roosting posture of the birds, and the frequent switching of cavities within the cavity cluster by individuals. Whereas the exceptional roosting of this one group could be considered a fluke, in 2004 I observed another group of Grey-and-buff Woodpeckers in East Kalimantan with much the same roosting situation and behaviour, and brief observations have been reported that support the notion that these roosting sites and behaviours are typical for the species

(Chasen 1939, Short 1973, Wells 1999). I report on observations made at Grey-and-buff Woodpecker group roost trees and discuss factors that may drive their exceptional roosting behaviour.

METHODS

While working for several years in Kalimantan on ecology and logging responses of woodpecker communities (Lammertink 2004a, 2004b, 2007, Lammertink *et al.* 2009), two chance finds of roosting sites of Grey-and-buff Woodpecker were reported to me. One roost site was found by Eka, the teenage son of my chief field assistant Pak Nan, just outside the boundaries of Gunung Palung National Park, West Kalimantan, near the settlement of Semanai at 01°18'51"S 110°04'35"E, elevation 10 m. At this site I made observations on 25 late afternoons between 13 July and 28 October 2000, on several days accompanied by Eka, U. Setiorini, D. Prawiradilaga or R. Otto. I made observations from ground blinds and later from tower blinds 8 and 11 m off the ground, 4.5 m from the roost trees, built by Pak Nan and his team to allow observations and photography at eye level. I entered blinds c.2 hours before sunset and left in total darkness c.50 minutes after the last woodpecker had settled for the night. I took photographs with a Leitz Telyt 6.8/400 mm lens and Nikon F3 camera on Kodachrome 200 slide film. For sound recordings I used a Sony TCD-D7 DAT Walkman and Telinga Classic microphone.

The second roost site was found in Sungai Wain Protected Forest, East Kalimantan, in July 2004 by G. Usher, a birder then residing in Samarinda. Accompanied by G. Usher, G. Fredriksson and U. Setiorini, I made observations at this roost on 7 and 8 August 2004, and digiscoped photos with a Leitz Telyt 6.8/400 mm with custom-built prism and eyepiece and Nikon Coolpix 990 camera. The roost site was located along the main trail in the reserve at approximately 1°06'00"S 116°49'38"E, elevation c.95 m.

At the West Kalimantan roost site I collected one branch with four cavities. I used the mean dimensions of the cavity entrances of this branch as a scale to measure diameters of other cavity branches in digital photos, using the ruler tool in Photoshop CS3 software (Adobe, San Jose, California). I estimated height of cavities and of trees in the field by counting in steps of an estimated 2 m up tree trunks. I obtained local sunset times from <http://aa.usno.navy.mil/>

data/docs/RS_OneYear.php and ran a Mann-Whitney U test at <http://elegans.swmed.edu/~leon/stats/utest.html> to contrast group sizes of Grey-and-buff Woodpeckers at roosts with group sizes encountered during daytime foraging. These latter figures derived from 21 occasions in West and East Kalimantan, between 21 February 1998 and 11 October 2000, from a transect effort of 1,529 km in 373 observer days by six observers (Lammertink 2007). Means are given \pm SD.

RESULTS

At the West Kalimantan site, roost cavities of one group of Grey-and-buff Woodpeckers were in two dead trees that stood 30 m apart. The roost trees were the only remaining trees in a flat open area with bare soil and ferns that had been burned repeatedly in previous years for clearing of agricultural land. The roost trees were c. 150 m from a forest edge that formed the boundary of Gunung Palung National Park, with tall, lightly logged dipterocarp rainforest at the edge (Plate 3). Both roost trees were long dead with most of their bark missing, bleached white and dried out, with the base of the trees burned. One cavity tree was 9.0 m tall, 15 cm in diameter at breast height (DBH), and c. 11 cm in diameter at cavity height. The tree had six completed cavities and one old, partly completed cavity. The cavities were between 6.8 and 8.0 m above the ground. The

second nearby roost tree was 13.0 m tall, 21 cm DBH, 8–9 cm diameter at cavity height, with cavities between 10.5 and 12.0 m height. This tree had seven cavities in one branch and one cavity (later increasing to four cavities) in another branch. Thus the total number of completed cavities of this group was 17, divided between two trees and three branches.

All cavities had oval entrances, taller than wide. In one collected branch, four cavity entrances measured 7.8×3.9 , 7.4×4.5 , 7.2×3.7 and 7.7×3.8 cm. From the lower lip of the cavity entrance to the bottom of the holes the depths were 2.5, 3.1, 2.0 and 2.6 cm, i.e. they were shallow. From the postures and visibility of the woodpeckers after they entered the other cavities it was clear that all of the cavities were similarly shallow.

In these cavity trees roosted a group of four Grey-and-buff Woodpeckers, composed of an adult male with a red crest, a juvenile male with an orange crest, and two females of unknown age (Plate 1). By 16 October the crest of the juvenile male was changing in colour, the tip of the crest turning red, the forehead still orange. The group arrived at the roost trees 29 ± 9 minutes ($n = 23$) before sunset, coming in with *kik* flight calls, and uttering long *chi-chi-chi-chi-chi* calls and descending *keyeew* calls while perched on the trees (a recording of these individuals is available at <http://macaulaylibrary.org/audio/164240>). Often the group called c. 15 minutes before arrival from 150 to 350 m away. Once on the roost trees, on two days the birds immediately entered cavities, but

Plate 1. A group of four Grey-and-buff Woodpeckers at a roosting tree. Juvenile male perched outside, adult male looking from uppermost cavity, and bills of females visible in lower cavity entrances. Semanai, West Kalimantan, Indonesia, September/October 2000 (M. Lammertink).



Plate 2. Grey-and-buff Woodpeckers at roost cavities. Male perched outside lower cavity, female perched inside upper hole on the bottom of a shallow roost cavity. Semanai, West Kalimantan, Indonesia, October 2000 (M. Lammertink).

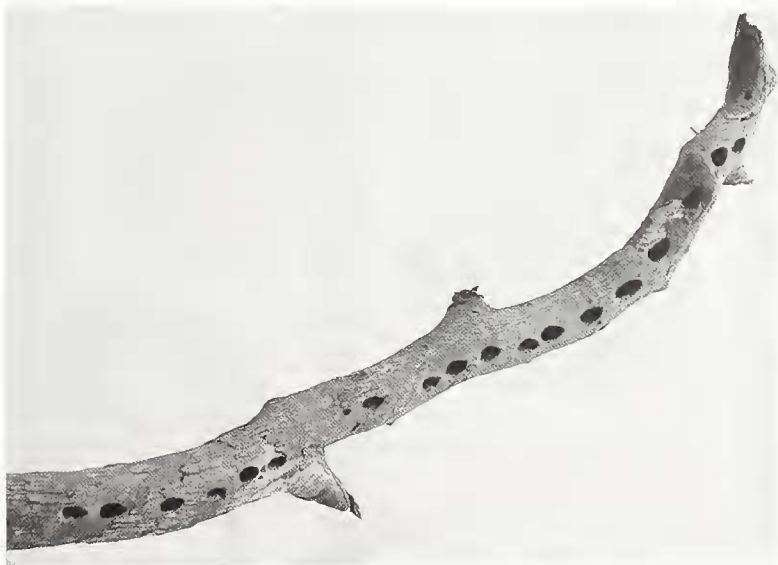




Plate 3. Wide-angle view from elevated blind showing two roost trees of a group of Grey-and-buff Woodpeckers. On the left roost tree four Grey-and-buff Woodpeckers are perched outside. On the right is a second roost tree also used by this group of woodpeckers, with a second elevated blind. In the background is the forest edge of Gunung Palung National Park. Semanai, West Kalimantan, Indonesia, October 2000 (M. Lammertink).

typically they spent c.11 minutes (up to 31 minutes) climbing and flying around between the many cavities, entering and leaving cavities, and occasionally fighting over cavities with bill pecks and aerial clashes. On six of the 25 observation days, birds excavated at several of the cavities for a total of 74 minutes, with most of the work done by the adult male, and for three minutes by a female. Between 24 July and 17 August two newly completed holes and one half-finished hole were made in one of the branches. After entering the roost holes, the Grey-and-buff Woodpeckers sat on the bottom of the shallow roost cavities, their upper body and head visible in

Plate 4. Branch with 18 cavities in an active roost tree of Grey-and-buff Woodpecker. Sungai Wain Protected Forest, East Kalimantan, Indonesia, 8 August 2004 (G. Usher).



the cavity entrance, facing outside (Plate 2). Occasionally they preened for several minutes in the cavities, and then tucked their heads in for the night, remaining visible in the cavity entrances until dark. The last individual to enter a cavity was usually the adult male. When the last individual entered it was 16 ± 7 minutes ($n = 16$) before sunset on days with dry weather, whereas on two days with heavy rain birds were in their roosts 40 and 60 minutes before sunset. One day with a dark thunderstorm the group arrived 112 minutes before sunset and sat out the storm and rain in cavities, then after the storm, 35 minutes later, came out again and spent the next hour chasing around the cavities and excavating. On three days, single birds (two females, one unidentified) visited the roost trees respectively 18, 8, and 35 minutes in advance of the arrival of the group. Individual woodpeckers rarely used the same cavity on consecutive nights but instead switched around all the time, and most of the 17 cavities were used during the observation period. Sometimes the four birds slept in cavities close together, all in a row of cavities in one branch (Plate 1), while at other times they were spread out over the two trees and three branches with cavities.

The roosting site in East Kalimantan had a total of 34 cavities spread out over five branches in the crown of a very large (105 cm DBH) standing dead bangkirai *Shorea laevis*. The tree was on a ridge in primary lowland forest, the cavity branches emerging in the canopy. All cavity branches had been dead for some time, with no leaves or twigs remaining, but still mostly covered in bark. One branch with a diameter of 18 cm had a row of 18 cavities (Plate 4) and was slanting at 40° angle from vertical, the cavity entrances facing the forest floor 28 m below. Three other branches respectively 13, 11 and 17 cm in diameter had four, two and five cavities located between 31 and 34 m above ground, and were near vertical in the portions with cavities. The final fifth branch that was the active



Plate 5. Group of three Grey-and-buff Woodpeckers at roost cavities in the same tree as the branch of Plate 4. Sungai Wain Protected Forest, East Kalimantan, Indonesia, 8 August 2004 (M. Lammertink).

roost branch at the time of observation was 25 cm diameter and had five cavities 34 m up in a near-vertical orientation. In this branch roosted a group of three Grey-and-buff Woodpeckers composed of an adult male and two females (Plate 5). We observed this roost on 7 and 8 August 2004, and found the group arrived 39 and 47 minutes before sunset and settled in 19 and 23 minutes before sunset. On the two days the individuals settled in different holes among the five in a branch, and the adult male excavated for a few minutes at one hole on 8 August. The five cavities in this branch were shallow, as the woodpeckers remained visible in the cavity entrances when they slept. We surmised that most of the 34 cavities in this tree were shallow roost holes, as many were distributed in closely stacked rows (Plate 4) which left little space for deep excavations to be possible. G. Usher (pers. comm.) observed three Grey-and-buff Woodpeckers roosting in these branches on several days 2–3 weeks before my visit.

The group sizes of foraging Grey-and-buff Woodpeckers that my team encountered on 21 occasions during fieldwork in Kalimantan consisted of solitary birds on nine occasions, two individuals on ten occasions (two of the duos were in mixed species flocks), and three individuals on two occasions. These group sizes of Grey-and-buff Woodpeckers encountered during daytime were significantly smaller than the two described roosting groups (Mann-Whitney $U=41$, $z=2.2$, $n_1=21$, $n_2=2$, $P=0.03$).

DISCUSSION

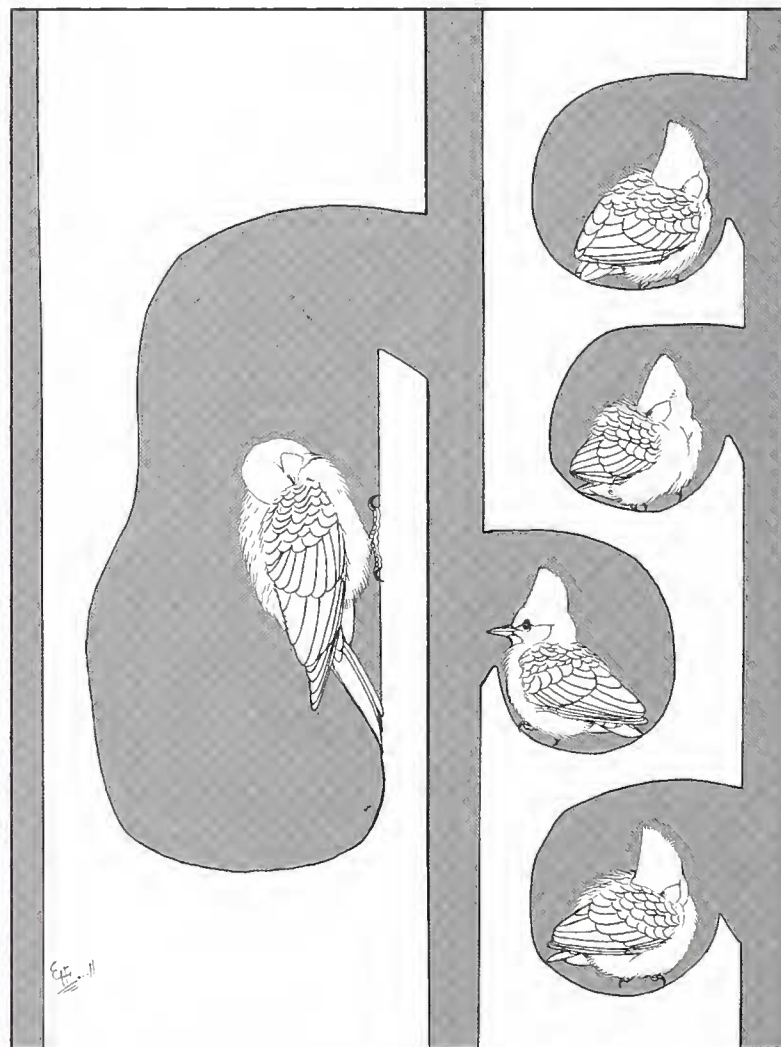
The roost cavities and roosting behaviour of Grey-and-buff Woodpecker observed were rather different from other woodpecker species. Grey-and-buff Woodpeckers roosted perched on the

bottom of shallow holes instead of against the wall of a deep hole as in most other woodpeckers (Figure 1). They roosted in groups, and made many more holes than apparently necessary for the size of the groups. They habitually returned to a roost site, but frequently switched cavities within the cavity cluster at a roost site.

The perching at cavity bottoms by roosting Grey-and-buff Woodpeckers is probably explained by their short tails, as extended overnight perching against a vertical wall may not be possible without a tail prop. Potential advantages of shallow cavities are that they may (1) offer better ventilation in a warm and humid climate, (2) be less prone to becoming usurped by secondary cavity users, and (3) take less effort to excavate. However, other woodpecker species use deep roost cavities despite the potential advantages of shallow roosts. Predation risk is probably higher in shallow cavities, but in the Grey-and-buff Woodpecker that risk might be offset by the extra vigilance and defence offered by group roosting. It is not clear why these woodpeckers make such large numbers of roost cavities at each roosting site; possible explanations include display behaviour, group bonding, and visual territory demarcation. A large number of cavities combined with frequent cavity switching probably results in reduced predictability for predators, and also in less accumulation and reduced survival of feather and skin parasites that infest cavities.

It is uncertain whether the groups of Grey-and-buff Woodpeckers seen at roosts spend the daytime together foraging as a group, or break up during daytime to reunite again near the roost sites. Group sizes encountered during daytime were significantly smaller than the two roosting groups, and this leads me to believe

Figure 1. Schematic cross section through roost trees showing two woodpecker roost situations. A typical woodpecker (left) roosts solitarily, perched vertically against the wall of a deep cavity. Grey-and-buff Woodpeckers (right) roost in small groups, in clusters of large numbers of nearby cavities, perched on the bottoms of shallow roost cavities (E. Hernández Fernández).



that roost groups may break up during daytime. This would also explain the three occasions when I observed solitary birds visiting roost trees 8–35 minutes in advance of the arrival of the group. Often groups can be heard calling several hundred metres from roost sites c.15 minutes before arriving, and perhaps that is where and when group reunite before returning to the roost sites. When Grey-and-buff Woodpeckers arrived to roost they were always with the full group.

Grey-and-buff Woodpeckers have been reported by other observers with rows of cavities similar to these roost sites. Chasen (1939) cited a note received from A. T. Edgar who observed two Grey-and-buff Woodpeckers exiting from two different cavities in a row of four near the top of a dead stump c.10 m tall. Short (1973) observed on one occasion a group of three Grey-and-buff Woodpeckers, a male and two females, at a row of four cavities, the male excavating for several minutes at the upper cavity, in the top of a 30-m dead tree in Peninsular Malaysia. Wells (1999) observed a pair at a row of eight holes, the male excavating on two days. None of these reports mentions the time of day of the observations. The occurrence of rows of cavities at all sites indicates these may have been group roosts, and demonstrates that cavity rows are common in this species. I have not been able to find any information about the roosting behaviour of the Heart-spotted Woodpecker *Hemicircus canente*, the only other species in the genus. Photos of Heart-spotted Woodpeckers at nests (<http://orientalbirdimages.org>) show oval cavity entrances similar in shape and size to those of Grey-and-buff Woodpecker.

Group roosting, either in cavity clusters or in a shared cavity, is rare among woodpecker species. It is found both in cooperative breeders such as Acorn Woodpecker *Melanerpes formicivorus* (shared cavities) and Red-cockaded Woodpecker *Picoides borealis* (cavity clusters) as well as in monogamous breeders with their offspring (Winkler & Christie 2002). For instance, Magellanic Woodpecker *Campephilus magellanicus* groups are composed of pairs with offspring from several years and these groups often roost in shared cavities (Chazarreta & Ojeda 2011). In Asia, Greater Flameback *Chrysocolaptes lucidus* roosts in groups of up to five individuals spread individually over rows of cavities, in trees with up to seven deep cavities (Short 1973). Grey-and-buff Woodpecker is distinguished from other known group roosters by the large numbers of its roosts, its frequent changes of roost holes, and the shape of the cavities. The shallow holes it makes are probably exclusively roost holes, as nest holes in this species probably need to be deeper to accommodate eggs and young, although this remains to be confirmed. A nest hole of the related Heart-spotted Woodpecker was 17 cm deep below the entrance (Wells 1999).

The exceptional roosting behaviour of the Grey-and-buff Woodpecker is of note in light of a recent molecular phylogeny which included one specimen of *H. canente* (Fuchs *et al.* 2007). The study indicated that *Hemicircus* is sister group of all other genera of true woodpeckers (Picinae, i.e. the Picidae without wrynecks and piculets). Molecular clock estimates suggest *Hemicircus* has been evolving independently from other woodpeckers for c.14 million years (Fuchs *et al.* 2007).

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Martjan LAMMERTINK, Cornell Lab of Ornithology, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY 14850, U.S.A. Email: jml243@cornell.edu Website: www.pbases.com/PicidPics